

A NEW SPECIES OF OREOHELICID LAND SNAIL FROM THE SAN AGUSTIN PLAINS, NEW MEXICO

Celinda R. Crews and Artie L. Metcalf

Abstract.—A new species of pulmonate land snail, *Oreohelix litoralis*, is described from populations inhabiting wave cut cliffs in the southern part of the San Agustin Plains, west-central New Mexico. Taxonomic evaluation is based on qualitative and quantitative characters of shell and genital structures. A redescription of *Oreohelix magdalenae* Pilsbry is provided, since it is considered to be closely related to *Oreohelix litoralis*. Both species are members of the *Oreohelix metcalfei* Cockerell complex within the *Oreohelix yavapai* Pilsbry group.

Most of the basic taxonomic work on the genus *Oreohelix* in New Mexico was done by H. A. Pilsbry and J. H. Ferriss, culminating in Pilsbry's (1939) monographic treatment of known species. A number of New Mexican oreohelicids were assigned to the wide-ranging *Oreohelix yavapai* Pilsbry, 1905, group. Taxa occurring in the Black Range and peripheral mountains in south-central New Mexico were ascribed to the *Oreohelix metcalfei* Cockerell, 1905, complex. Metcalf (1974) discussed and referred several species to this complex, including *Oreohelix magdalenae*, Pilsbry, 1939, as a northeastern derivative. The new species described below is judged to be a northern derivative of this complex and to be closely related to *Oreohelix magdalenae*.

Oreohelix litoralis, new species

Figs. 1A, B, C; 2A; 3A

Description of shell of holotype (from Locality 6).—Shell slightly depressed, convex dorsally and ventrally; spire forming angle of 118° ; 16.4 mm in diameter and 9.7 mm in height; upper lip descending only slightly; angular peripherally with angularity at about mid-height of body whorl; first 2 whorls keeled; aperture slightly ovate horizontally, 7.7 mm wide and 6.2 mm high; aperture oriented at angle of 54° to vertical axis of shell; umbilicus open, not contracting rapidly within, 3.9 mm wide, contained 4.21 times in diameter; sutures moderately impressed; 5.10 whorls; dorsal surface generally smooth, with sculpture limited to growth lines, weak and irregularly spaced on early whorls, becoming stronger on body whorl; ventral surface smooth with only low growth lines (no spiral striae or lirae); earliest 2.25 whorls of dorsal surface uniformly cinnamon brown, grading to grayish brown mottling on a whitish background by whorl 3 with mottled pattern extending to body whorl; thin brown band appears at 2.25 whorls, extending to body whorl; this band situated approximately one-third whorl-width inward from suture on earlier whorls and approximately one-third whorl-width above angulation on body whorl; ventral surface with grayish-brown mottling mainly descending ("bleeding") from thin brown band present on body whorl immediately beneath angulation.

Variation in shells.—Variation in shell measurements and proportions for 20

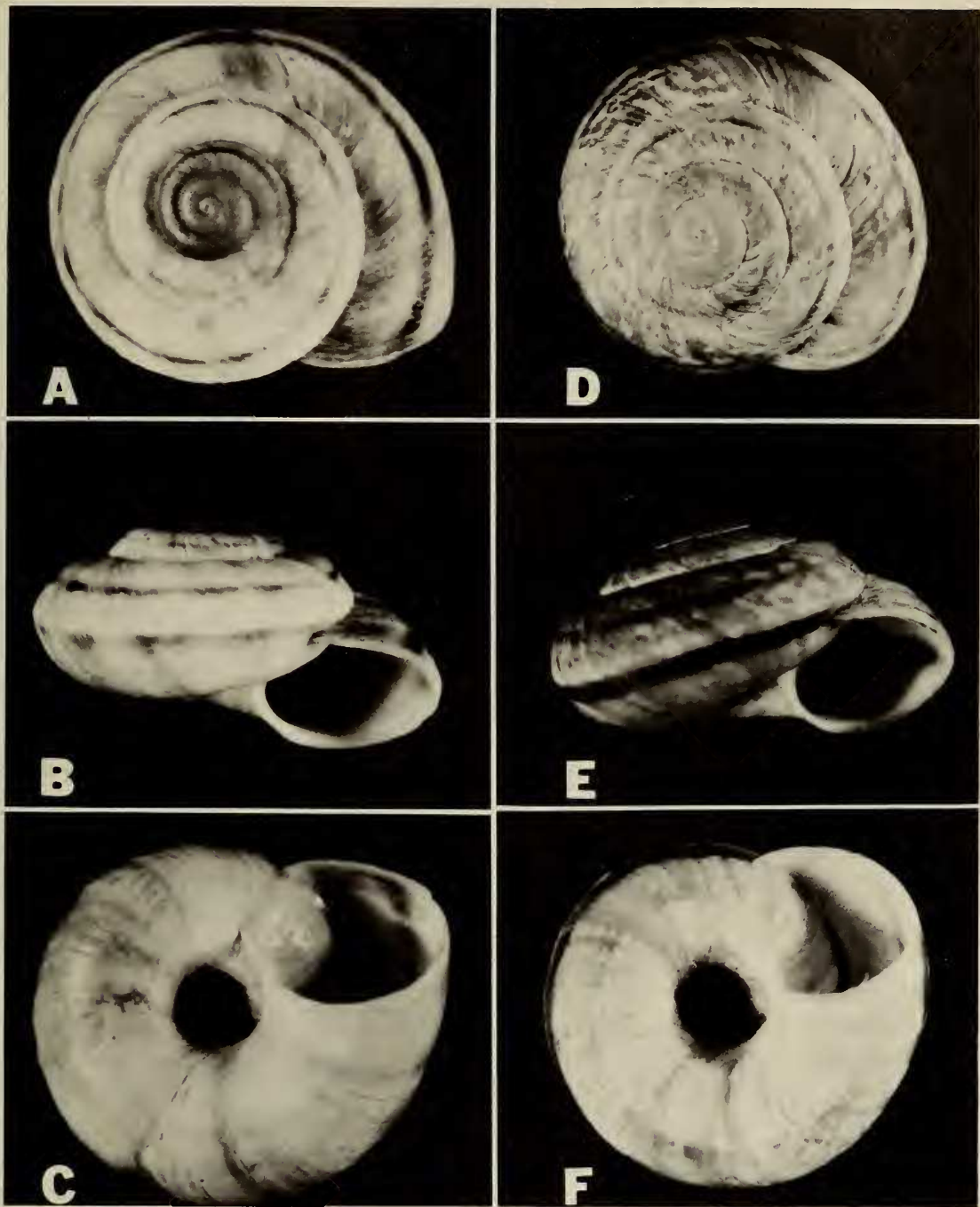


Fig. 1. A, B, C, Shell of holotype of *Oreohelix litoralis* (diameter, 16.4 mm); D, E, F, Shell of *Oreohelix magdalenae* from Loc. 9 (diameter, 15.7 mm).

specimens each from Localities 6 and 7 is given in Table 1. A few paratypes are less depressed than the holotype. Descent of the body whorl ranges from weak to marked. Shape of the aperture ranges from round to oval. Banding and other coloration varies little among paratypes from Localities 1–7. There is a variable degree of fading, due to wear, on the ventral surface of the last half of the body whorl.

Description of genitalia (based on dissections of 5 paratypes from Locality 6; collected in Dec. 1979; see Figs. 2A and 3A).—Lower penis swollen, upper penis bearing small, rounded appendix laterally; internally, lower penis bears 2–4 irregular longitudinal pilasters, upper penis with close-set pustules, varying in size;

Table 1.—Some shell and genital measurements (mm) and proportions for *Oreohelix litoralis* and *Oreohelix magdalenae*. Mean and standard deviation (in parentheses) are given above and range below. D = diameter.

	<i>O. litoralis</i> Loc. 6; n = 20	<i>O. litoralis</i> Loc. 7; n = 20	<i>O. magdalenae</i> Loc. 9; n = 20		<i>O. litoralis</i> Loc. 6; n = 5	<i>O. magdalenae</i> Loc. 9; n = 5
Diameter	18.9 (1.01) 17.2–21.5	17.5 (0.86) 16.2–19.9	14.0 (0.88) 12.8–15.7	Penis	8.3 (0.41) 7.8–8.9	8.9 (0.67) 7.9–9.6
Height	11.7 (0.89) 10.0–13.6	11.2 (1.03) 10.0–13.6	8.5 (0.61) 7.5–9.5	Epiphallus	3.4 (0.41) 2.8–3.8	3.4 (0.37) 2.8–3.8
Aperture width	8.8 (0.64) 7.5–10.3	8.4 (0.75) 7.1–10.4	6.5 (0.38) 5.9–7.1	Vas deferens	6.3 (0.47) 5.8–7.0	9.8 (0.44) 9.4–10.5
Aperture height	7.1 (0.42) 6.2–7.8	7.8 (0.57) 6.5–8.8	6.2 (0.29) 5.7–6.7	Vagina	3.2 (0.34) 2.9–3.8	3.2 (0.21) 3.0–3.5
Umbilicus width	5.1 (0.47) 4.5–6.2	4.4 (0.39) 3.9–5.1	3.7 (0.30) 3.2–4.3	Free oviduct	3.2 (0.41) 2.7–3.6	2.7 (0.29) 2.3–3.0
No. of whorls	5.33 (0.122) 5.10–5.55	5.16 (0.141) 4.90–5.40	4.61 (0.206) 4.25–5.00	Spermathecal duct plus sac	12.6 (1.03) 11.5–13.6	11.9 (0.72) 10.9–12.6
D/height	1.62 (0.102) 1.38–1.84	1.58 (0.096) 1.35–1.72	1.65 (0.068) 1.55–1.83	D/penis	2.00 (0.147) 1.82–2.15	1.56 (0.106) 1.44–1.69
D/aperture width	2.14 (0.077) 2.01–2.31	2.10 (0.097) 1.91–2.29	2.15 (0.089) 2.00–2.31	D/epiphallus	4.92 (0.553) 4.42–5.79	4.12 (0.379) 3.55–4.61
D/aperture height	2.67 (0.135) 2.43–2.99	2.26 (0.106) 2.05–2.49	2.25 (0.136) 2.02–2.53	D/vas deferens	2.62 (0.210) 2.39–2.88	1.42 (0.083) 1.33–1.51
D/umbilicus width	3.75 (0.237) 3.38–4.22	4.01 (0.264) 3.49–4.39	3.76 (0.210) 3.34–4.11	D/vagina	5.15 (0.591) 4.42–5.76	4.41 (0.366) 4.03–4.77
D/no. of whorls	3.55 (0.179) 3.23–4.02	3.40 (0.145) 3.11–3.69	3.03 (0.112) 2.83–3.27	D/free oviduct	5.26 (0.574) 4.67–6.19	5.16 (0.606) 4.70–6.22
				D/spermathe- cal duct plus sac	1.32 (0.042) 1.26–1.36	1.17 (0.077) 1.07–1.27

upper and lower penis approximately equal in length; penial verge short; penial retractor muscle strands attached to both upper penis and epiphallus at their juncture; epiphallus relatively long and slender, tapering at upper end; vas deferens inserts centrally on upper terminus of epiphallus; vagina stout, widening at upper end; free oviduct stout, widening at base; albumen gland short and muzzle-shaped with slightly darker pigmentation; talon hook-like, black in color, slightly swollen and of moderate size relative to albumen gland; spermathecal sac oval to suboval. Lengths of some genital organs and ratios of shell diameter to organ lengths are given in Table 1.

Description of embryonic shells.—Embryos taken from a single dissected specimen from Locality 6 possess 2.55, 2.60, and 2.65 whorls and diameters measure 4.2, 4.1, and 4.2 mm, respectively. Overall color is cinnamon brown as seen in live adult shells for approximately the earliest 2.5 whorls (first 2.25 whorls in the holotype). Banding is faint, but discernible dorsally after the second whorl. Embryonic shells are keeled, but possess no cuticular projections.

Remarks.—On 11 October 1980, *Oreohelix litoralis* was found in crevices and in rock rubble of wave cut cliffs on the southern margin of the San Agustin Plains at an elevation of approximately 2105 m (6900 feet) (Loc. 6). Rocks were igneous,

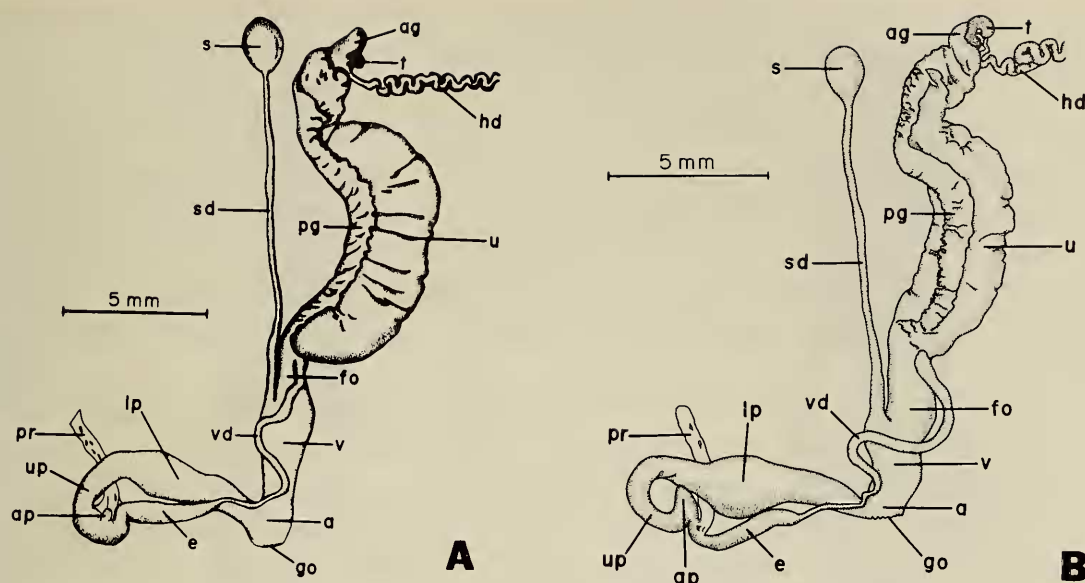


Fig. 2. A, Genitalia of *Oreohelix litoralis*; B, Genitalia of *Oreohelix magdalenae*. lp = lower penis; up = upper penis; ap = appendix; pr = penial retractor muscle; e = epiphallus; vd = vas deferens; pg = prostate gland; v = vagina; fo = free oviduct; u = uterus; ag = albumen gland; t = talon; hd = hermaphroditic duct; sd = spermathecal duct; s = spermathecal sac; a = atrium; go = common gonopore.

mainly rhyolite tuff, welded tuff, and scoria. The area is grassland with sparse shrubs, in contrast to the forested habitats observed in association with most occurrences of *Oreohelix*. Common plants included *Atriplex canescens* (four-winged saltbush), *Rhus aromatica* (lemon sumac), *Brickellia* sp. (brickellia), *Lycium* sp. (wolfberry), and *Bouteloua gracilis* (blue grama grass).

Live, aestivating individuals were found attached to small rocks in rubble, on the underside of larger stones in talus, and beneath low ledges at the base of the cliffs. *Oreohelix litoralis* at this locality seemed colonial, with up to 11 individuals clustered under one rock. Both live and dead snails were abundant. The harsher environment occupied by these populations (relative to montane populations) may be related to the high degree of colonialism observed.

Disposition of types.—The holotype (Fig. 1A, B, C) is a fresh shell with desiccated soft parts (National Museum of Natural History 784661). The paratypes are fresh shells with desiccated soft parts (National Museum of Natural History 784662; University of Texas at El Paso 7725, 8467, 8593–8594; Academy of Natural Sciences of Philadelphia 354156; University of Arizona 19016; Dallas Museum of Natural History 5364).

Etymology.—The epithet *litoralis* (L., of the shore) refers to occurrence of populations of the species along wave cut cliffs of the former shoreline of Pluvial Lake San Agustin.

Oreohelix magdalenae Pilsbry

Figs. 1D, E, F; 2B; 3B

Oreohelix socorroensis magdalenae Pilsbry, 1939: 515, Fig. 336b (Type: Magdalena Mountains, Socorro County, New Mexico; ANSP 158166).

Oreohelix magdalenae.—Metcalf, 1974:99.

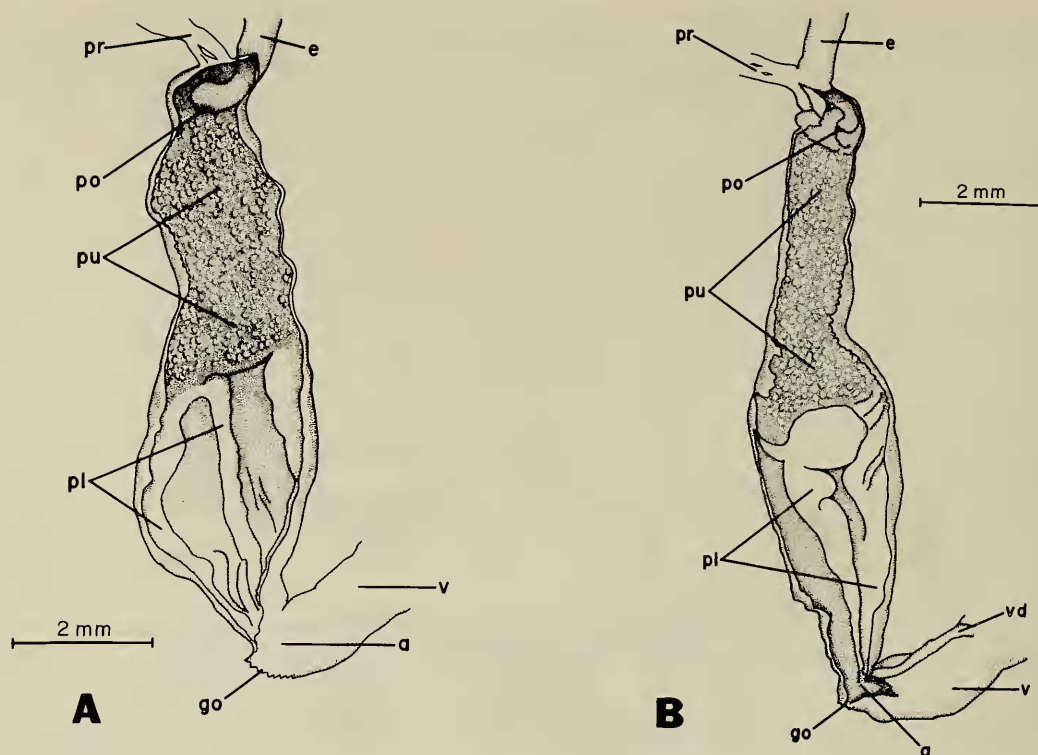


Fig. 3. A, Longitudinal dissection of the penis of *Oreohelix littoralis*; B, Longitudinal dissection of the penis of *Oreohelix magdalanae*. pr = penial retractor muscle; e = epiphallus; po = pore; pu = pustules; pl = longitudinal pilasters; v = vagina; a = atrium; go = common gonopore.

Description of shells (based on 20 specimens from Locality 9).—Shell slightly depressed to, in a few specimens, pyramidal; diameter 12.8–14.7 mm (mean 14.0 mm); height 7.5–9.5 mm (mean 8.5 mm); descent of body whorl slight to none; approximately first 2.25 whorls keeled, becoming angular peripherally with angularity at about mid-height of body whorl; aperture rounded to oval perpendicular to parietal wall, 5.9–7.1 mm wide (mean 6.5 mm) and 5.7–6.7 mm high (mean 6.2 mm); umbilicus open and ample, 3.2–4.3 mm wide (mean 3.7 mm), contained 3.34–4.11 times within diameter (mean 3.76 times); 4.25–5.00 whorls (mean 4.61 whorls); dorsal surface generally smooth with faint lirae on earliest approximately 2.5 whorls, not extending to later whorls; transverse growth lines on first 2.5 whorls, becoming more irregular and increasing in strength on outer whorls; ventral surface sculpture limited to transverse growth lines; dorsally, first 2.5 whorls dark gray, grading to a dull gray and brown mottled pattern intersected by irregular transverse white bands that increase in area on outer whorls; thin brown band evident dorsally after first whorl, becoming stronger on later whorls and extending to body whorl, band located approximately one-third whorl-width above suture on earlier whorls and one-third whorl-width above peripheral angulation on body whorl; ventrally, irregular gray, white, and brown transverse zones of coloration with last 0.5 body whorl worn to tan on some specimens; ventral band located immediately below peripheral angulation, distinct, and approximately 3 times size of dorsal band. Additional data on variations in shell measurements and proportions are given in Table 1.

Description of genitalia (based on dissections of 5 specimens from Locality 9, collected on 20 April 1980; see Figs. 2B and 3B).—Lower penis greatly swollen,

approaching a bulbous condition; large, prominent lateral appendix on upper penis; internally, lower penis with 2 to 3 irregularly shaped longitudinal pilasters; upper penis with numerous suboval pustules, varying in size; upper and lower penis approximately equal in length; penial verge slight; penial retractor muscle with attachment to both upper penis and epiphallus; epiphallus long and slender; central insertion of the vas deferens onto the apex of the epiphallus; vagina stout, slightly swollen at emergence of spermathecal duct; free oviduct also stout, slightly larger at base than top; spermathecal sac oval; albumen gland more darkly pigmented, relatively small; talon hook-like and black, large relative to albumen gland.

Of a second group of 5 dissections done on specimens of *O. magdalенаe* collected at Locality 9 on 19 May 1981, 3 specimens of adult size (diameters 14.0, 12.5, and 12.5 mm) had the same overall development of the genitalia as seen in the first group of dissections. However, 2 seemingly subadult specimens showed varying degrees of development of the genital organs. One specimen (diameter 10.0 mm) had only slight evidence of the lower genitalia (penis-vagina area only), with no development of the uterus-prostate area. Another specimen (diameter 10.6 mm) showed the beginning of development of the uterus-prostate area, with lower genitalia developed, but not of full size.

Lengths of some genital structures and ratios of shell diameter to organ lengths for 5 adult specimens are given in Table 1.

Remarks.—At Locality 9, *O. magdalенаe* was found living under loose igneous stones at 2230 m (7320 feet) elevation. Vegetation included *Pseudotsuga menziesii* (Douglas fir), *Pinus ponderosa* (ponderosa pine), and *Quercus gambelii* (Gambel's oak) on the slope where collections were made, with *Populus angustifolia* (narrowleaf cottonwood) common along a brook below the slope. A few specimens were collected (Robert H. Weber) at another site in the range (Locality 8) near the summit of North Baldy Peak at approximately 3000 m (9850 feet).

At Locality 9, on 20 April 1980 and 19 May 1981, aestivating individuals occurred under stones both attached and unattached with epiphragms intact. One individual was active under a stone on 20 April 1980. Two to 3 live individuals occurred together under some stones.

Embryos were absent in uteri of specimens dissected, indicating that development to observable size (or perhaps fertilization) had not yet occurred or that deposition of young had occurred before these (spring) dates noted. It is logical to suppose that deposition of young should occur before or during the early phase of the summer rains to allow subsequent development under favorable conditions. No detailed account of the life history has been published for any species of *Oreohelix* in New Mexico.

Distribution

Oreohelix litoralis, as now known, occurs in local populations along the southern margin and on an isolated hill arising from the floor of the San Agustin Plains. *Oreohelix magdalенаe* occurs in local populations in the Magdalena Mountains, east of the Plains. These species seem to represent northern, peripheral derivatives of the *Oreohelix metcalfei* complex. This complex is centered in the Black Range, to the south, with several peripheral species in outlying ranges (Metcalf

1974:99). Ancestors of the 2 species possibly migrated northward during Pleistocene pluvial episodes. The occurrence at Locality 1 is described by Robert H. Weber (in litt.) as follows: “an isolated outcrop on the floor of the lake plain, separated from the cliffs . . . by nearly two miles of open grassland. The hill was submerged at water levels about 6885 feet [2098 m], and was an island between that level and a little over 6800 feet [2073 m].” Weber (pers. comm.) indicates that the hill was submerged in Pluvial Lake San Agustin during the late Wisconsin rise of the lake and that it was, for a time, an island during the time of lake recession in the earlier Holocene. Thus, colonization of the hill by *O. litoralis* seems to have taken place during the past 10,000 years. Mountain ranges immediately south of the San Agustin Plains have not been investigated malacologically.

Differential Diagnoses and Discussion

Although *O. litoralis* seems closely related to *O. magdalenae*, it is judged sufficiently distinctive to warrant specific rank. Shells of *O. litoralis* are larger, overall, than shells from populations of *O. magdalenae* observed (Table 1), and possess more strongly indented sutures and a slightly higher spire. In *O. litoralis*, no lirae are present either dorsally or ventrally, whereas the dorsal surface of *O. magdalenae* possesses faint lirae on the earliest ca. 2.5 whorls. Although a mottled color pattern is observed in both species, shells of *O. magdalenae* are dominated by a darker gray and brown and exhibit less diffuse mottling, with white areas being restricted and more distinctly demarcated. Both species possess a thin brown band dorsally and a second band below the peripheral angulation. However, in *O. litoralis* the 2 bands are approximately equal in size with the lower band diffusing ventrally (“bleeding”), whereas the lower band in *O. magdalenae* is 3 times the width of the upper and discrete.

The overall shell size and number of whorls observed in *O. litoralis* and *O. magdalenae* generally are closer to those recorded for taxa in the *O. metcalfei* complex (Pilsbry 1939:507–514; Metcalf 1974:95–98) than to those observed for other members of the *Oreohelix yavapai* group occurring in New Mexico. Both *O. litoralis* and *O. magdalenae* have peripheral angulation at about mid-height of the body whorl in adult shells. Other geographically peripheral taxa (see above) of the *O. metcalfei* complex also are angular peripherally, in contrast to the carinate condition seen in centrally located (i.e., Black Range) taxa. The peripheral taxa of the complex, along with *O. litoralis* and *O. magdalenae*, also have shells that are less depressed, and with more rounded (biconvex) whorls than those seen in centrally located members of the *O. metcalfei* complex. Banding is relatively prominent and surface sculpture is not elaborate, generally lacking prominent striae and lirae, in *O. litoralis*, *O. magdalenae*, and other peripheral taxa of the *O. metcalfei* complex.

We regard the characters exhibited by *O. litoralis*, *O. magdalenae*, and other peripheral taxa—angulation opposed to strong keeling, higher elevation of the spire, biconvex shells, relatively smooth surface sculpture, and relative prominence of banding—as conservative and opposed to more advanced characteristics seen in taxa in the center of distribution (i.e., Black Range) of the *Oreohelix metcalfei* complex. These latter species possess varying degrees of carination and

depression of shells, elaborate spiral and/or radial surface sculpturing, and lack prominent banding. Metcalf (1974:99) noted that banding in *O. confragosa* Metcalf, 1974 (which occurs west of the Black Range and which he believed to be more closely related to the peripheral taxa) is weak in living specimens, but more prominent in fossil shells. If the two-banded pattern in *Oreohelix* is an ancestral feature of the genus in the process of disappearing (Pilsbry 1939:413), then the evolution towards the loss of banding observed by Metcalf would seem to support the view that the strongly-banded peripheral taxa of the *Oreohelix metcalfei* complex are more conservative.

Pilsbry (1939:510) reported the presence of prominent “triangular processes” (cuticular projections) on the keel and dorsal and ventral surfaces of embryonic shells of taxa in the *O. metcalfei* complex in both peripheral and centrally located taxa. Unfortunately, embryonic shells of *O. magdalenae* were not available for comparison. However, embryonic shells of *O. litoralis* differ from those reported for other members of the *O. metcalfei* complex in possessing a relatively smooth surface and lacking these cuticular projections.

The genitalia of *O. litoralis* are similar to those of *O. magdalenae* in possessing a swollen lower penis, a lateral appendix situated on the upper penis, and a relatively reduced albumen gland (Figs. 2A, B). However, the degree of swelling of the lower penis is much greater in *O. magdalenae*, approaching a bulbous condition, and reduction in size of the albumen gland is greater. The appendix also is larger and more pronounced in specimens of *O. magdalenae*. Several subspecies of *O. metcalfei* were reported by Pilsbry (1939:511) as having the lower penis “much swollen.” However, the genitalia of most subspecies have not been described in detail or illustrated for comparison. No information is available regarding the presence of a lateral appendix on the upper penis in this complex, with the exception of *O. confragosa* (Metcalf 1974:96–98), which possesses a small, lateral, cornuted appendix. Insertion of the vas deferens is central in *O. litoralis* and *O. magdalenae*, but has not been reported for other taxa of the *O. metcalfei* complex.

List of Localities

Localities are listed west to east. Localities 2–7 are in areas of wave-cut cliffs along the generally southern shore of Pluvial Lake San Agustin.

1 New Mexico: Catron Co.: on isolated outcrop on floor of Pluvial Lake San Agustin (former island): T6S, R14W, SW¼ SE¼ NW¼ Sec. 28:2040 m (6700 feet): 33°45'34"N; 108°17'29"W (Robert H. Weber, collector; Nov. 1981).

2 New Mexico: Catron Co.: T7S, R14W, NW¼ NE¼ NW¼ Sec. 2: 1950 m (6400 feet): 33°44'05"N; 108°15'26"W (Robert H. Weber, collector; Sept. 1981).

3 New Mexico: Catron Co.: T6S, R14W, NE¼ NE¼ SW¼ Sec. 26: 1950 m (6400 feet): 33°45'26"N; 108°15'22"W (Robert H. Weber, collector; Sept. 1981).

4 New Mexico: Catron Co.: shore of Pluvial Lake San Agustin: T6S, R14W, NE¼ SE¼ SW¼ Sec. 35: 2040 m (6700 feet): 33°44'24"N; 108°15'18"W (Robert H. Weber, collector; Sept. 1981).

5 New Mexico: Catron Co.: T6S, R14W, SE¼ SE¼ SE¼ Sec. 24: 2075 m (6800 feet): 33°46'00"N; 108°13'44"W (Robert H. Weber, collector; Sept. 1981).

6 Type locality of *Oreohelix litoralis*. New Mexico: Catron Co.: center, boundary T6S, R11W, Sec. 6 and T6S, R12W, Sec. 1: 2105 m (6900 feet): 33°48'54"N; 108°01'16"W (collected by Robert H. Weber, Dec. 1979, and by A. L. Metcalf and C. R. Crews, 11 Oct. 1980).

7 New Mexico: Catron Co.: T5S, R11W, SW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 27: 2105 m (6900 feet): 33°50'28"N; 107°59'01"W (Robert H. Weber, collector; 28 Nov. 1979).

8 New Mexico: Socorro Co.: Cibola Natl. Forest: Magdalena Mts.: summit of North Baldy Peak: T3S, R3W, SE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 17: 3005 m (9858 feet): 34°03'02"N; 107°10'56"W (Robert H. Weber, collector; May 1976).

9 New Mexico: Socorro Co.: Cibola Natl. Forest: Magdalena Mts.: T3S, R3W, SW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 21: North Fork Cn.: 2.6 km (1.6 mile) by road from Water Cn.: base of N-facing slope: 2230 m (7320 feet): 34°01'47"N; 107°09'16"W (A. L. Metcalf and C. R. Crews, collectors; 20 April 1980; 19 May 1981).

Acknowledgments

We are grateful to Dr. Robert H. Weber, New Mexico Bureau of Mines and Mineral Resources, who first apprised us of *Oreohelix litoralis* and generously supplied specimens from several localities.

Literature Cited

- Metcalf, A. L. 1974. Peripheral species of the *Oreohelix metcalfei* Cockerell complex (Pulmonata: Oreohelicidae).—*The Nautilus* 88:94–100.
- Pilsbry, H. A. 1939. Land Mollusca of North America (north of Mexico).—Academy of Natural Sciences, Philadelphia, Monograph 3:1(1):i–xvii + 1–573 + i–ix.

Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, Texas 79968.